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AUTHOR Broadhead, Sandra Stolworthy
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ABSTRACT

This study had a two-fold purpose. It was concerned both with the effect of programed articulation therapy on Spanish-speaking subjects and with the role that distinctive features play on the phonological rules that affect articulation of three English phonemes. Fourteen adult Spanish-speaking subjects were involved and each demonstrated a functional misarticulation. Programed therapy proved to be a sufficient technique for improving misarticulation for two of the three phonemes. A comparison between the Spanish distinctive features and the English distinctive features proved that Spanish subjects substituted known Spanish distinctive features for unknown English distinctive features, thus explaining several misarticulations. These results are important to the therapist, for they point to an efficient therapy program and show that by looking at the underlying rules it is possible to gain a broader and more complete picture of what creates the misarticulations in each of the Spanish-speaking adults. (Author/JM)

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THE MODIFICATION OF SELECTED DISTINCTIVE FEATURE RULES OF ENGLISH IN SPANISH SPEAKING ADULTS

BY

SANDRA STOLWORTHY BROADHEAD, B.A.

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A Thesis submitted to the Graduate School

in partial fulfillment of the requirements

for the Degree

Master of Arts

Major Subject: Speech

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"The Modification of Selected Distinctive Feature Rules of English in Spanish Speaking Adults," a thesis prepared by Sandra Stolworthy Broadhead in partial fulfillment of the requirements for the degree, Master of Arts, has been approved and accepted by the following:

_____

Dean of the Graduate School

_____

Chairman of the Examining Committee

_____

Date

Committee in charge:

Dr. Edgar R. Garrett, Chairman

Dr. James C. Moore

Dr. Betty Lou Dubois

Dr. Guadalupe Fallis

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With love and appreciation, I dedicate this thesis to my parents for without their everlasting encouragement and backing, I would never have been able to achieve this goal. And to my husband, I give my deepest love, for without his keen interest, incisive criticism, and ability to do statistics, this thesis would never have been possible.

VITA

April 22, 1951 - Born at Farmington, New Mexico

1969 - Graduated from Farmington High School, Farmington, New Mexico

1973 - B.A., Speech Pathology, New Mexico State University

1973-1974 - Graduate Assistant, Dept. of Speech, NMSU

PROFESSIONAL SOCIETIES

American Speech and Hearing Students Association

FIELDS OF STUDY

Major Field: Speech Pathology

Studies in Speech Therapy
Professor Edgar R. Garrett

Studies in Audiology
Professor Kathleen McCarren

Studies in General Speech
Professor Gordon R. Owen

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Doctor Edgar R. Garrett, Chairman

This study had a two-fold purpose. It was concerned not only with the effect of programmed articulation therapy on Spanish speaking subjects; but also, it was concerned with the role that distinctive features play on the phonological rules that affect articulation of the English phonemes /v/, /ð/, and /θ/. Fourteen adult Spanish speaking subjects were involved and each demonstrated a functional misarticulation.

Programmed therapy proved to be a sufficient technique for improving misarticulation for the phonemes /v/ and /θ/ but not for the phoneme /ð/.

A comparison between the Spanish distinctive features and the English distinctive features proved that Spanish subjects substituted

known Spanish distinctive features for unknown English distinctive features, thus, explaining several misarticulations.

These results are very important to the therapist for they point to an efficient therapy program and show that by looking at the underlying rules that it is possible to gain a broader and more complete picture of what is creating the misarticulations in each individual case of Spanish speaking adults.

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INTRODUCTION

> For language permeates all human activity. It is so much part and parcel of human life that it is normally taken for granted. It is when the problem of choice of language presents itself that the extent of human dependence upon it becomes obvious. We then become conscious of language as language, of its form and references, its role in thinking and communication, its social and political functions. When bilingualism enters into the activities of man, the problems are not only linguistic, or social, or psychological; they may interest any of the several disciplines dealing with human activity--any and all of the human sciences. (L.G. Kelly)

In developing a theory that describes language as a system governed by rules, linguists are involved in a search for the many factors that constitute a phonological system. In our language, each phoneme can be described as a bundle of features. Within a distinctive feature framework, the child acquires features in a developmental sequence. In recent studies, some researchers have suggested that the distinctive feature theory may be applied to the analysis of children's speech. From the point of view of linguistic analysis, one of the major steps forward in the study of child language was made when Roman Jakobson saw a path through the unrestricted jungle of child phonology. The distinctive feature theory in combination with Jakobson's directed attention to the sequence of acquiring sound categories has become a major field of research for the speech pathologist who is interested in describing a child's articulation acquisition.

Survey of Literature

Although the general outlines of distinctive feature theory were announced as early as the late nineteenth century by the Pole Jan Baudouin de Courtenay, the founder also of modern phonemics and morphemics, and even though much has been postulated about a universal language and its bundle of features, only two theories about such a system have been formally stated. Jakobson, Fant, and Halle (1952) theorized that phonological rules posit the establishment of such rules in the child's perceptual system as a prior basis for their application in articulatory performance. However, the second theory, stated by Kennedy (1973) postulates that the development of a phonological system arises from experiences that have an articulatory origin.

The term "bundle of features" is synonymous with Jakobson's, Fant's, and Halle's (1952) term "distinctive features." They define distinctive features as the smallest linguistic units of language. Any phoneme, according to their system, consists of these simultaneous distinctive features. A phonemic pattern is formed by a finite set of distinctive features and a finite set of rules for grouping them into phonemes and into a sequence. With this phonemic pattern, a language code is established. The individual phonemes are described by Halle (1964) in terms of acoustic correlates which have some reality in the articulatory domain. The use of a feature scheme having acoustic and articulatory correlates implicitly relates perceptual performance to articulatory performance in the child's acquisition of phonology.

Jakobson, Fant, and Halle (1952) give a detailed description of their distinctive features, listing twelve pairs, none of which are used in English. However, ten pairs will be described using their spectographic and physiological production characteristics. Their system of distinctive features is presented in three major categories; the fundamental source features, secondary consonantal source features, and the resonance features. Only the first feature of each pair will be described.

I. Fundamental Source Features

1. Vocalic vs. Non-Vocalic

a. Spectographic: "periodic source without an abrupt onset."

b. Production: "no obstructive barrier along the median line of the mouth cavity."

2. Consonantal vs. Non-Consonantal

a. Spectographic: "have several blanks."

b. Production: "barrier sufficient to produce either complete occlusion or a turbulent noise source."

II. Secondary Consonantal Source Features

3. Interrupted vs. Continuant

a. Spectographic: "abrupt onset."

b. Production: "varying degrees of closure followed up opening."

4. Strident vs. Mellow

a. Spectographic: "irregular wave form."

b. Production: "noise due to turbulence at point of articulation."

5. Voiced v. Voiceless

a. Spectographic: "superpcsition of a harmonic sound source upon the sound source."

III. Resonance Features

6. Compact vs. Diffuse

a. Spectographic: "one dominant formant region."

b. Production: "more volume of the resonating cavities in front of the narrowest structure."

7. Grave vs. Acute

a. Spectographic: "lower horizontal portion predominate."

b. Production: "a larger and less comparted mouth cavity."

8. Flat vs. Plain

a. Spectographic: "flattening in a downward shift of part or all formants."

b. Production: "reduction of the lip orifice with a concomitant increase in the length of the lip constriction."

9. Tense vs. Lax

a. Spectographic: "longer sound intensity and a larger energy."

b. Production: "articulated with greater distinction and pressure."

10. Nasal vs. Oral

    a. Spectographic: "two constant and clear formants which are relatively stable, one at 250 cps and one at 2500 cps."

    b. Production: "lowering of soft palate so that the air stream is bifurcated and the mouth resonator is supplemented by the nasal cavity."

It is felt that perception is based on an aggregate of features which differentially group phonemic classes and much support for consonant perception based on a feature system has come from several investigations. Miller and Nicely (1955) found that perceptual confusion among consonants presented to subjects under different conditions of noise and frequency distortion could be analyzed effectively by classifying sounds according to five distinctive features of voicing, nasality, affrication, duration, and place of articulation. All of the features were classed as to their presence or absence except for place of articulation which was classed as front, middle, and back. Peters (1963) had subjects compare consonant pairs on a similarity scale and found that three features of manner, place, and voicing were used to explain the responses of his subjects. Wickelgren (1966) observed that errors in short term memory could be predicted on the basis of similarity of the features which he feels characterize the American English consonsnts. Although Wickelgren used only four feature dimensions, he included three levels of openness of the vocal tract and five levels of place of articulation (Schieb and Sharf 1972).

In an article on children's acquisition of phonology, Menyuk (1968) presented data showing that distinctive features and their theory may provide for the description of the sound systems of children with functional articulation problems. In another article, Crocker (1969) constructed a theoretical linguistic model of children's developing competence in their phonological development of consonants. Crocker's model was based on the competence model of Chomsky (1968) and Halle (1964). He also based the model on the distinctive features and the model devised by Jakobson, Fant, and Halle (1952). At this time, Crocker began to form a framework of the phonological system which develops from all available distinctive features the finite number for a given language.

Winitz (1969) also devised a framework of the phonological system and at the same time began to caution the clinician. He recommended that the clinician should give more attention to factors such as the distinctive features of sound production, interference, motivation, the process of extinction, delayed reinforcement, latency of response, and retention of the response during his misarticulation therapy. Compton (1970) went on to point out that phonological principles or rules cannot be ignored, since failure to take account of these rules leads to hit and miss therapy which may not only be ineffective but also may sometimes even create new misarticulations. In reviewing Winitz (1968), McReynolds and Houston (1971) postulates that the severity of articulation problems may frequently be a function of the number of phonemic rules that are different in a child's system. They feel that distinctive features provide a tool in assessing childrens' use of phonemic rules and whether

the necessary motor responses are present in their articulatory system McReynolds and Bennett (1972) found that newly acquired features will generalize to phonemes in which the feature has not been trained.

Singh and Frank (1972) worked with the idea that substitutions made by children with an imperfect consonantal system shows substantial regularity. They felt that the fewer features a child has learned, the fewer phonemes are possible, and the more substitutions he has to make. No phonemes are immune to substitution, but not all phonemes are used for substitution. Most substitutes differ from the "correct" phoneme by just one feature.

Pollack and Rees (1972) believe that a child's articulatory behavior may yield an individual phonological system with its own patterns and rules. They feel that this theory has the advantage of providing an economical description of the child's phonological system, that it may be applied constructively at every level or stage of the clinical management of a child with a functional articulatory disorders, and the results may be more efficient than usual articulatory inventories. They feel it is important to consider which feature combinations the child has incorporated into his system.

Even though Winitz (1969), McReynolds and Houston (1971), and Singh and Polen (1972) suggest that distinctive features are a potentially powerful tool in describing articulatory errors and serving as a basis for planning modification. Research incorporating distinctive features has been scarce. The few reports based on distinctive features have led to some negative reactions. For example, Walsh (1974)

feels that most modern phonological systems operate on an idealized level of language whereas speech pathologists operate on a level that violates all norms because they work with individual cases.

Although some studies have been concerned with comparing English distinctive features with those of another language, there is no evidence that the distinctive features approach has been applied to the articulation problems of the Spanish speaker learning English.

Malmberg (1963) feels that when one hears a sound sequence in an unknown language, he tries to segment it on the basis of the model he has in his own language. He refers the acoustic stimuli to the different phonemes of his own language basing his identification on sound resemblence and on distribution. Malmberg implies that the listener decomposes the unit heard into its distinctive features.

Lado (1957) suggests that there are three checks which point out sources of problems for second language learners. He asks these three questions: (1) does the native language have a phonetically similar phoneme; (2) are the variants of the phonemes similar in both languages; and (3) are the phonemes and their variants similarly distributed. The first of Lado's checks revealed six phonemes which the Spanish speaker will encounter for the first time in English: /I/, /æ/, /a/, /v/, /ʌ/, and /ɝ/. Because of this new encounter, the Spanish speaker will then substitute a known Spanish phoneme that is similar to the unknown English phoneme. Thus, the substitution that occurs will lead to misarticulations of the new English words that contain the new phonemes. It must be remembered that each language uses only a small number of the

many possible ways of distinguishing sounds and that no two languages use the same set of distinctions in the same way.

Purpose of the Study

While working with the English As A Second Language Program (ESL) at New Mexico State University, the writer noted that most of the students knew and understood the grammatical rules concerning English; yet when producing conversational speech, they could not be understood. The conclusion was that they had nct gained the concepts of English phonological rules.

This study had a two-fold design. First, it tested the efficiency of programmed therapy in teaching the correct production of English phonemes to Spanish speaking students. The null hypothesis, in this case, was that the Automated Stimulus Control System (ASCS) and the Microunit, programmed therapy techniques, would have no effect on the articulation skills of the Spanish speaking students. If this null hypothesis were rejected then the ASCS and the Microunit could be viewed as very favorable approaches to use when teaching Spanish speaking students to correctly articulate the various English phonemes.

Secondly, the study tested the hypothesis that the ESL students misarticulated English phonemes because they substituted known Spanish phonological rules for the unlearned or unknown English phonological rules.

The null hypothesis, in this case, was that articulatory changes in English phonemes produced by Spanish speaking students would not be accompanied by changes in phonological rules.

If this null hypothesis were rejected, the study would support the idea of Jakobson, Fant, and Halle (1964) that acquisition of distinctive feature rules precedes articulatory skills. That is, that under the distinctive feature theory, the Spanish speaking student must understand the phonological rules of English before he can correctly articulate the various English phonemes. The clinician, during the evaluation of the student's competence in producing English phomemes, would only be concerned with each of the distinctive features involved which are present and which are absent, rather than the actual phoneme being misarticulated.

On the other hand, if the null hypothesis were supported, then the actual articulation would tend to come before the development of the phonological rules. If this were the case, then the theory stated by Kennedy (1973) would become relevant, and the Spanish speaking student would first have to acquire accurate articulation before understanding the phonological rules of English. The clinician, during the evaluation of the student's competence in producing English phonemes, would only be concerned with the actual phoneme and its production.

The phonemes selected for this study were /v/, /ð/, and /θ/. They were chosen because they seemed to be the most frequently misarticulated phonemes made by Spanish speaking students learning to speak English. The /v/ and /ð/ are two new encounters met by the students when they first begin to speak English. Many of the sounds in the Spanish language function together, as a single phoneme while in English these same sounds are two separate and distinct phonemes. The /d/ and /ð/ are sounds that function, as a single unit or phoneme in the Spanish language.

DESIGN

Subjects

Fourteen students of the third semester English As A Second Language class at New Mexico State University were chosen to participate in the experiment. They were required to have the following characteristics:

1. Spanish as their native language.
2. Normal hearing in the speech range.
3. Have a functional misarticulation.
4. Have passed the Solution State Test (SST).

The SST is a quick and powerful test to determine whether a student will respond to systematic articulation therapy programs. Given an auditory-visual model phoneme such as /s/, can the student produce the phoneme in a syllable within two trials, if not, can he produce the cognate /z/ within two trials?

Procedure

A Pre-test was run on each of the fourteen students by tape recording fifteen minutes of their conversational speech. The tapes were then used in order to obtain a baseline measurement of the students and their misarticulation of the phonemes /v/, /ʒ/, and /θ/. The name of this baseline measurement is "Properant." Rigg (1967) devised the Properant in order to measure the acceptability of a student's articulation in on-going speech. The Properant is made by tape recording a fifteen minute session of the student's speech behavior and getting a minimum of forty trials of the target phoneme. The actual Properant is then

taken from this sampling and is the proportion of correct responses to the total number of trials for each phoneme. The Properant is always a number between 0 and 1; 1 indicates perfect articulation of the target phoneme and 0 indicates a total absence of acceptable productions of the target phoneme. For example, on a recording of the student's conversational speech, if the student used the phoneme /v/ correctly forty-four times out of a total of one hundred attempts, his /v/ Properant score would be .44.

When all the Properant scores for each of the three phonemes /v/, /ð/, and /θ/ on each of the fourteen ESL students were derived, the writer then ranked the scores from high to low for each of the three phonemes. A selection of four students was then made concerning the /v/ phoneme by noting those who had the lowest four scores. The same procedure was used for the /ð/ and the /θ/, except that there were five students in each of these categories.

Two very quick and efficient systematic therapy programs were chosen to be used with these students because they all demonstrated functional misarticulations. The first program chosen was the Automated Stimulus Control System (ASCS). In 1962, Garrett (1968) began to apply and develop a programmed instruction for the rehabilitation of functional misarticulation, for he believed that adequate methods existed that could be used to shape acceptable articulatory patterns through an automated system. In 1964, Garrett (1968) began the first major study in the application of programmed instruction at New Mexico State University. Programmed tapes were developed in order to train the

auditory discrimination of speech sounds and for the self-correction of functional misarticulation. Positive findings in the above study indicated clearly that functional misarticulations could be treated successfully with the Automated Speech Correction Program. Garrett and Rigg (1968) then devised a system, the Automated Stimulus Control System which added the elements of traditional feedback and immediate reinforcement to the programmed instruction. It can be administered by a clinician or may be done through the use of a teaching machine. It consists of two phases of training, an auditory discrimination and a production phase. Each phase is divided into seven sets and each set consists of a fixed and sequentially more complex number of stimulus-response frames. In this study only the second phase was administered by the therapist. This phase proceeds from simple nonsense syllables to complex phrases and sentences. Each frame was presented to the student in an echoic fashion. The student never repeated a frame and when his response was correct the therapist would press a clicker which provided positive feedback for the correct response and at the same time tallied the number of correct trials. When the student was incorrect the therapist would stop and wait 3.5 seconds and then go on to the next frame. Each set was timed from the start until the student had completed the last frame.

The second program chosen was the Microunit which represents another type of programmed therapy. In 1967, McLean established a procedure of programmed antecedent stimulus conditions under positive reinforcement contingencies (Wolfe, 1973). McLean first evoked the

target phoneme in words by presenting echoic stimuli and then shifted the correct response to the control of three types of stimuli-pictures, graphemes of the words, and interverbal chains which had previously evoked incorrect responses. Each program consisted of ten words. The words were presented until a set criterion was met before moving to the next stimulus condition. Under the echoic condition, the subject had to reach a criterion of fifty per cent correct on four successive blocks. When this had been reached, the picture stimulus was then paired with the echoic program and the subject then had to reach a criteria of twenty correct responses in twenty paired presentations. When this had been reached the response was elicited by the picture stimulus alone, and the subject had to reach a criteria of thirty-eight correct responses out of a total of forty productions. The same criteria of thirty-eight correct responses out of a total of forty productions were applied to the grapheme and interverbal conditions.

Garrett revised McLean's procedure by changing the criteria that were to be met, and the pairing of conditions was dropped. The criterion for going from one condition to the next was reduced to ten out of ten successive correct productions and a maximum of three seconds was set for the presentation of the stimuli. If the responses were correct the therapist would immediately present the next stimuli, but if it were wrong the therapist would stop and wait 3.5 seconds before presenting the next stimulus. There were five stimulus conditions that the student was presented; the echoic, pictorial, graphemic, interverbal, and functional. Each condition was timed from the first stimulus

presented until the last one was presented. In this study, Garrett's Microunit was used instead of McLean's original program.

By a flip of a coin, the students who were misarticulating the /v/ and /θ/ were assigned a therapy program in order to insure random selection. The students who were chosen because of their misarticulation of the /ð/ were put on ASCS. The therapy session lasted as long as it took each student to reach criterion on the Microunit or to complete a set on the ASCS. For ASCS, the average time for a set was three minutes and eleven seconds, for a total time of 23 minutes spread over seven days. For the Microunit, the average time for a condition was three minutes and eleven seconds; for a total time of 15 minutes spread over seven days. The forms on pages 17 and 18 were used to collect the data obtained from each of the students during the therapy sessions.

The experimenter had received a year's training in the administration of ASCS and Microunit therapy. This training included reliability in judgement of no more than 2.5 per cent variation on repeated evaluations of standard tapes. This level of relability was still available to the experimenter.

A final Properant was taken after the therapy sessions were completed. Another Properant score was derived and the scores from the first or Pre-Properant were then compared to the scores from the second or Post-Properant. This was done in order to find out if there was any significant change between baselines due to the therapy administered.

In order to compare the means of the Pre- and Post-Properants a "pooled estimate of the standard deviation" was used. (Alder 1968)

Each null hypothesis was tested by using the Student t-Test to see if the differences between the means were significant at the .05 level of significance (Alder, 1968).

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Clinician: _____ Student: _____

Phoneme: _____

Phase II-1:

Date: _____ Time: _____

Total Trials: _____ Errors: _____ Correct: _____

Phase II-2:

Date: _____ _____ Time: _____

Total Trials: _____ Errors: _____ Correct: _____

Phase II-3:

Date: _____ Time: _____

Total Trials: _____ Errors: _____ Correct: _____

Phase II-4:

Date: _____ Time: _____

Total Trials: _____ Errors: _____ Correct: _____

Phase II-5:

Date: _____ Time: _____

Total Trials: _____ Errors: _____ Correct: _____

Phase II-6:

Date: _____ Time: _____

Total Trials: _____ Errors: _____ Correct: _____

Phase II-7:

Date: _____ _____ Time: _____

Total Trials: _____ Errors: _____ Correct: _____

Figure 1

ASCS Recording Form

Clinician: _____ Student: _____

Microunit Condition: _____ Date: _____ Time: _____

Correct: _____ Total Trials: _____ Phoneme: _____

Errors: _____

Target Word	1	2	3	4	5	6	7	8	9	10
1										
2										
3										

Figure 2

Microunit Recording Form

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RESULTS

The computation for determining the difference between sample means by phoneme and by treatment is summarized in Tables 1 and 2. The assumptions were that the observations in each sample (students in each group) were randomly selected, the observations were independent (were not affected by each other within the group), and the population represented by the samples were normally distributed.

Since the two population variances were independent and based upon $(n_1 + n_2 - 2)$ Degrees of Freedom, the experimenter combined the information in order to obtain a single, better estimator of the population variance. Called the "pooled estimator of the population variance" and denoted by S_p^2, its value is:

$$S_p^2 = \frac{\text{Pooled SS}}{\text{Pooled df}} = \frac{SS_1 + SS_2}{(n_1 + n_2 - 2)}$$

The term "SS" means the corrected sum of squares. It is computed by subtracting the $(\Sigma X)^2/n$, called the correction factor, from the term ΣX^2, called the uncorrected sum of squares. When the term SS is divided by the Degrees of Freedom, it then becomes known as the mean square (MS) or the sample variance (Alder 1968).

The null hypothesis in each case was that the means of the samples, as true estimates of the population means, are equal, or $\bar{X}_1 = \bar{X}_2$, or the therapy had had no effect on the students' articulation of the particular phoneme tested. The level of significance chosen was .05.

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Table 1

Summary of Statistical Analysis by Phoneme

Phoneme	Mean Change in Properant Scores	t-value	Degrees of Freedom	Probability
/v/	.40	-2.093	6	>.05
/ð/	.63	-1.077	8	>.05
/θ/	.56	-5.520	8	<.001
Combined	.54	-7.865	26	<.001

Table 2

Summary of Statistical Analysis by Programmed Therapy

Treatment	Mean Change in Properant Scores	t-value	Degrees of Freedom	Probability
ASCS	.48	-5.379	16	<.001
Microunit	.63	-8.606	8	<.001

For /v/, the mean change in Properant scores was .40, the calculated t-value was -2.093, the Degrees of Freedom were 6, and the probability of success was greater than .05; thus the therapy was not significant at the pre-established level, and the null hypothesis was accepted. However, at the .10 level, it was significant. For /ð/, the mean change in Properant scores was .63, the calculated t-value was -1.077, the Degrees of Freedom were 8, and the probability of success was greater than .05; thus, the therapy was not significant, and the null hypothesis was accepted. For /θ/, the mean change in Properant scores was .56, the calculated t-value was -5.520, the Degrees of Freedom were 8, and the probability of success was less than .001; thus, the therapy was highly significant, and the null hypothesis was not accepted. For all the phonemes combined, the mean change in Properant scores was .54, the calculated t-value was -7.865, the Degrees of Freedom were 26, and the probability of success was less than .001; thus the therapy as a whole was highly significant and the null hypothesis was not accepted.

The students had been divided into two groups; those students that used the ASCS and those students who used the Microunit. For ASCS, the mean change in Properant scores was .48, the calculated t-value was -5.379, the Degrees of Freedom were 16, and the probability of success was less than .001. For Microunit, the mean change in Properant scores was .63, the calculated t-value was -8.606, the Degrees of Freedom were 8, and the probability was less than .001.

It is apparent when looking at each of the phonemes /v/, /ð/, and /θ/ that a definite and consistent relations occurred between them and

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the phonemes that were being used as their substitutes. The voiceless phoneme /θ/ was always substituted by the voiceless phoneme /s/, and the voiced /ð/ was always substituted by the voiced phoneme /d/. Yet, even though the ESL students substituted the /s/ for the /θ/ and the /d/ for the /ð/, it was never bi-directional, i.e., the /θ/ was never substituted for the /s/ nor was the /ð/ ever substituted for the /d/ phoneme. It has been noticed that sometimes the /v/ phoneme is substituted with the Spanish phoneme /β/ (Wise, 1965) but with the four students within the study, this was not the case.

When looking at the distinctive features of each of the phonemes /v/, /ð/, and /θ/, it can be seen that between the Spanish /b/, /d/, and /s/ for the above English phonemes not more than two distinctive features are different. For example:

Spanish /b/:		English /v/:
non-vocalic		non-vocalic
consonantal		consonantal
oral		oral
diffuse		diffuse
grave	(feature difference which created misarticulation)	grave
lax		lax
----------	←——————→	continuant
----------		----------

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Spanish /d/:		English /ð/:
non-vocalic		non-vocalic
consonantal		consonantal
oral		oral
diffuse		diffuse
acute	(feature difference which	acute
lax	created misarticulation)	lax
----------	⟷	continuant
----------	⟷	mellow

Spanish /s/:		English /θ/:
non-vocalic		non-vocalic
consonantal		consonantal
oral		oral
diffuse		diffuse
acute		acute
tense	(feature difference which	tense
continuant	created misarticulation)	continuant
strident	⟷	mellow

CONCLUSION

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From the statistical data run on the therapy sessions, as a whole, it can be concluded that both the Microunit and the ASCS were successful programmed therapy techniques for establishing correct production of the phonemes /v/, /ð/, /θ/ among the ESL students. However, when breaking down the data into the separate phonemes it can be seen that the /ð/ phoneme did not reach a level of significance and therefore it can be concluded that therapy was not effective. The same conclusion can be reached for the /v/ phoneme at the .05 level of significance yet, at the .1 level the results were significant and it can be said that at this level the therapy did make a difference on the Properant scores on each of the students. The /θ/ phoneme however, was highly significant at the .001 level of significance and it is apparent that therapy was quite successful with this phoneme.

It can be concluded from the distinctive feature analysis that there was not a true discrimination problem for if it had occurred each of the phonemes would have substituted for one another. For example, the /s/ would have substituted for the /θ/ and the /θ/ would have substituted for the /s/ phoneme when it was present. However, this was not the case; the /s/ only substituted for the /θ/. It is apparent from this study that voiceless sounds will always substitute for voiceless sounds and voiced sounds will always substitute for voiced sounds. And also that the sounds that are being substituted differ from the desired sound by at most two distinctive features. It must

be remembered that in Spanish there are two different /d/ sounds and that these two sounds function together as a unit in the language and that this distinctive unit is called a phoneme. Yet, in English these same two sounds function as two distinct phonemes /d/ and /ð/. They are each distinctive sound units in English while in Spanish they are non-distinctive sounds. This played a very important role in the analysis of /ð/.

The patterns the misarticulations follow are shown to start from a relatively small number of rules that underlie and create a much larger deviant surface on top. The rules apply to the phonemes which make up a class of sounds sharing not less than six distinctive features in common. The student's actual speech production was dependent on each of these rules in order to establish the correct coherent system needed in producing the wanted speech sound. The distinctions between the features, however, are not easy enough to distinguish and do not allow for very accurate observations at the present time. Without accurate observations in a diagnosis, the therapist then cannot create an accurate therapy program.

There was not substantial data to definitely support either of the theories because it could not be shown that the rules learned on the phoneme being trained transferred to a phoneme not being trained. However, the writer feels that the results of this study tend to verify the hypothesis that the ESL student misarticulates English phonemes because he substitutes known Spanish phonological rules for the unlearned or unknown English phonological rules. And, it also tends to support

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Jakobson's, Fant's and Halle's distinctive feature theory because the errors that were being made were phonemic and not phonetic. Each of the students' had the ability to execute articulatory movement but had deviant phonological systems.

Research is still needed in the area of distinctive features but the results from this study show that they can be used successfully in correcting a functional misarticulation disorder. By comparing the English phonemes with the Spanish students' phonemes and their features, it is possible to gain a broader and more complete picture of the underlying rules that create the observable misarticulations. It is safe to assume that the phonological rules are established before the articulation ability and that with the help of the distinctive features the therapist can correctly select a program that will help the Spanish student quickly correct those misarticulations caused by incorrect usage of the phonological rules.

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